

Regulatory Concerns with Pesticide Use in Turf*

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Abstract: Because of the costs incurred in their development, it is unlikely that pesticides will be developed solely for use in amenity turf. This means that the basic set of data needed to answer regulatory concerns should already be available for the pesticide concerned. The basic controls involved in pesticide registration are described, with the EC being taken as an example. The paper describes the areas where, because of different concerns, more data may need to be generated in order to seek registration of use of a product on amenity turf. In most cases regulatory requirements can be met by reinterpreting the existing data, taking into account the use of pesticides on amenity turf. Other regulatory issues concerning the use of pesticides in amenity turf are discussed.

Key words: turf, pesticides, regulations, amenity

1 INTRODUCTION

Amenity turf is beset by similar problems to those in any other 'crop'. Fungicides, insecticides and herbicides are required to control diseases, insects and weeds that attack it and plant growth regulators are used to control the growth of grass species comprising the turf. Some problems found in turf are less common elsewhere. Control of moss is needed only on buildings and hard surfaces in addition to turf, while problems with earthworm casting are specific to turf. To control the problems identified, the substances used must obviously be biologically active. There are concerns that these substances may also be active against humans or other non-target organisms, so regulations are set up to control their use. When considering 'pest' control in amenity turf, 'pest' is taken to include fungi, invertebrates, weeds and sometimes vertebrates. 'Pesticides' are substances that control these organisms and also regulate the growth of plants.

In the UK, different amenity areas have been defined in order to regulate pesticide use in such areas. This will help users to know which products can be used in a

particular situation. Grassed amenity areas have been split into the two categories, 'Managed Amenity Turf' and 'Amenity Grassland'. 'Managed Amenity Turf' is frequently mown, intensively managed turf which encompasses turf in public parks, golf courses, sports fields etc. 'Amenity Grassland' is semi-natural or planted grassland with minimal management; this includes areas such as railway and motorway embankments, airfields and grassland nature reserves which are not intended for grazing.

Most pesticide use will take place in managed amenity turf, but amenity grassland can receive the occasional treatment for a particular problem. Regulatory control of pesticides is the same for both areas but there may be different concerns about their use in the two areas. For the purposes of these definitions, there can be no utilisation of the grass in these areas for grazing or as animal feed.

2 PESTICIDE ACTIVE INGREDIENTS LIKELY TO BE USED IN AMENITY TURF

In order to consider how regulations will affect the use of products in amenity turf, the basic assumption will be made that, due to the size of the market for pesticides in this area, pesticide active ingredients will not be developed specifically for this purpose. Products used in the

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sector will contain active substances that have been developed and registered, or are in the process of being registered, for other uses where there is a larger market. The cost of discovering and developing a pesticide is so great that it is unlikely that an agrochemical company will pursue an active substance that could only be used in amenity turf, even if it had a world-wide market in this area. New active substances being examined for use in other areas might be identified for amenity turf use, then costs of developing the active substance would be spread across several sectors. Once it is discovered that an existing active substance could usefully be deployed in amenity turf, it would not be unusual for a specific product to be developed for use in the area, possibly with its own formulation.

As amenity turf is obviously made up of different grass species, any pesticide developed must be selective when applied to such species. This means that pesticide active substances moving into the amenity turf area will often be registered first for use on cereals or agricultural grassland. There are some specific problems on amenity turf that do not appear, or are unimportant, in these crops, so that some active substances may be adopted from other sectors, such as horticulture.

Whitehead¹ lists 36 active substances as being registered for use on turf and amenity grass in the UK, of which 22 are also registered for use on cereals or agricultural grassland. Of the remaining 14, there are 12 active substances which are also registered for uses other than amenity turf. The two active substances that are registered for use only on amenity turf are ferrous sulphate for moss control, and mefluidide, a turf growth regulator. This confirms the suggestion that active substances for use on amenity turf will be adopted from other areas, or be developed in conjunction with those uses.

3 BASIC REGULATORY CONTROLS OVER PESTICIDES OPERATING IN THE UK AND EUROPE

In order to understand the regulatory concerns that might apply to an amenity turf product, the UK and EC schemes will be taken as examples. UK legislation states that the reason for regulating pesticide use is to protect the health of human beings, creatures and plants, to safeguard the environment and to secure safe, efficient and humane methods of controlling pests.²

Within the EC, harmonisation of the controls over plant protection products has been introduced; an EC Directive known as the 'Authorisation Directive' (Council Directive 91/414/EEC³) laid down the basic framework for the harmonised controls. A two-stage system came into operation on 26 July 1993. The UK has introduced the Plant Protection Product Regula-

tions 1995⁴ to implement controls over pesticides in line with the Directive.

Under the provisions of the Directive a positive list (Annex I) of active substances which may be authorised for use within the Community will be established. For new active substances, a report is prepared by a Member State following the evaluation of all the supporting data. This report will be considered by a committee, made up of representatives from all Member States, known as the Standing Committee on Plant Health (SCPH). They will vote on the acceptability of authorisation of a given active substance for use within the Community.

Restrictions may be placed on the Annex I entry, such as the maximum dose to be applied or the areas in which the active substance can be used. The issue of restrictions is under consideration but the UK holds that it is important that these restrictions should be proposed only where the available data indicate that they are required, such as to protect human or animal health, or the environment. This would avoid placing unnecessary conditions on the active substance and avoid the need to amend the Annex I listing to allow additional uses and thus would favour amenity turf, where the first application for Annex I listing of an active substance may be for use in other situations. Following Annex I listing, product authorisation, the second stage of the process, takes place at Member State level. It is at this stage that efficacy data are required.

4 REVIEW OF EXISTING PESTICIDES

In common with registration schemes operating elsewhere in the world, the EC has introduced a programme to assess whether the data available meet all present concerns over the use of pesticides. In the first year of the programme 90 active substances were listed for review. Member States are currently evaluating data to support Annex I listing of these review-active substances. As for new substances, Annex I listing will be considered by the SCPH, following which product authorisations (re-registration) may be granted at Member State level. Until the process of Annex I listing followed by product re-registration (if the active substance is acceptable) has been carried out, national rules still apply.

Companies must decide whether to carry out the tests required to bring the data package for a given material up to modern standards. In the first round of the EC Review programme, of the 90 active substances listed, it appears that only four were not supported at review. None of these was used on amenity turf. There will be further lists of active substances produced. Where these substances are used in other major markets, as well as

in amenity turf, any additional data required are likely to be generated and the substance likely to be supported at review.

5 GENERAL SAFETY CONSIDERATIONS FOR AN AMENITY TURF PRODUCT

Central to the EC's harmonised evaluation of pesticide authorisations has been the laying down of data requirements for each area of concern and the principles for how these data shall be evaluated by Member States. The data requirements for efficacy (Commission Directive 93/71/EEC),⁵ physical and chemical properties (Commission Directive 94/37/EC),⁶ toxicology (Commission Directive 94/79/EC)⁷ and fate and behaviour in the environment (Commission Directive 95/36/EC)⁸ have been published; other areas are under discussion. The principles of evaluating the data submitted have been established as the 'Uniform Principles' (Council Directive 94/43/EC).⁹

A company developing an amenity turf product must consider which data requirements will apply to their product that will not have been provided already in order to register the active substances contained in the product for other purposes. In many cases when considering an application for authorisation, the company will not have to carry out further tests but instead will have to draw up a case for how the existing data support use in amenity turf.

5.1 Toxicity and consumer exposure

Basic toxicity data should be available for an existing active substance, including data on aspects such as mutagenicity and carcinogenicity. If a new formulation is developed for turf use, new toxicity data specific to the formulation might have to be generated. Routes by which operators and bystanders are exposed to the compound may be different for turf use; this is dealt with below. Under the definitions given in the introduction, use on these areas is allowed only if there is no utilisation of the grass by livestock; this means a consumer risk assessment is not required. In some cases livestock may be grazed on the less intensively managed amenity grassland such as railway embankments and airfields; in this situation a product which is registered for use on agricultural grassland must be used.

5.2 Formulation stability

It has been a requirement in the UK for some time, and it is now a requirement under the 'Authorisation Directive', that a product formulation is tested to ensure that it is stable when stored. If a new product is developed

for amenity turf use, with a different formulation, new storage stability data are likely to be required.

5.3 Fate and behaviour in the environment

A particular concern in the EC has been the possibility of the active substance moving by leaching or run-off to ground or surface water. One of the reasons for this is the introduction of the Drinking Water Directive (Council Directive 80/778/EEC),⁶ which sets the limit in drinking water at $0.1 \mu\text{g litre}^{-1}$ for an individual pesticide and $0.5 \mu\text{g litre}^{-1}$ for the total of all pesticides. The basic chemical properties of an active substance which are used to forecast its fate and behaviour should be available. Results from more specialised studies, such as column leaching and lysimeter tests, may also be available. These data must be interpreted for the situation being examined. There are concerns that amenity grassland areas, such as railway and motorway embankments, could be close to drains. Allied to this is the fact that doses required for effective pest control may be higher in amenity turf than in, for example, cereals or amenity grassland. These two factors mean that use in this situation could pose a threat of water contamination.

Applicants for approval have claimed that there will be greater interception by the grass than with an arable crop so that the risk will be reduced. The UK is not aware of any generic data which quantify interception by turf, so that, in the absence of evidence, it can only be assumed that all the product applied reaches the soil surface. Problems with fate and behaviour must be fully addressed in any application for authorisation for use on amenity turf.

When considering the EC scheme, the 'Uniform Principles'⁹ state that, in some circumstances, a pesticide that may lead to infringements of the limits set for pesticides in drinking water may be conditionally authorised for five years.¹⁰ This would be allowed only if levels in drinking water are not likely to exceed a level determined as acceptable, based on examination of toxicology data and as long as a monitoring scheme will be operated in the Member State concerned.

In the evaluation of pesticides under the 'Authorisations' Directive,³ the movement of pesticides via vapour drift to damage adjacent crops or non-target organisms must be considered. As a result, possible vapour drift must be quantified. Some products used on turf contain active substances in the ester form, which may be prone to vapour drift.

5.4 Effects on all types of non-target organisms

For approval of an active substance in cereals or other crops, a range of tests should have been carried out to establish the levels at which the active substance affects

non-target terrestrial and aquatic organisms. For use in amenity turf, it must be considered whether the exposure of these organisms to the active substance is greater than in the situation already considered. Amenity grassland, as previously defined, is considered to be of greater value to wildlife, including flora, than managed amenity turf. Another consideration is the dose to be applied; if, in the amenity situation in general, a higher dose is applied or a greater number of applications are made, a higher residue might develop on the grass than would be the case in the agricultural situation. This could affect non-target organisms that graze the turf. The likelihood of the active substance reaching water will affect whether it could harm aquatic organisms; this must also be considered in light of the fate and behaviour assessment.

In most cases new data will not be required to answer these concerns. A revised risk assessment will need to be drawn up, possibly with a risk management strategy, for use of the product on amenity turf. One possible area of difference would be a consideration of the effects an earthworm control agent might have on non-target worms.

The ecotoxicity assessment takes into account the formulation to be applied. So, if a new formulation is created for amenity turf use some additional ecotoxicity testing of that formulation may be required.

6 EXPOSURE OF OPERATORS AND BYSTANDERS

Assessment of risk to human health through exposure to pesticides involves comparing the likely level of exposure with that, identified from appropriate toxicology tests, at which there is a negligible risk of adverse effects in humans. Three categories of people may be exposed as a result of the use of a pesticide in amenity turf. These are operators applying the pesticide, bystanders present at the time of application, and people who are exposed to foliar or soil residues on entry to treated areas. Operators are workers who actually handle and apply the pesticide. Bystanders can be other workers whose presence is not connected with the application, or members of the public, who are incidentally exposed during the application. The third category may be workers mowing treated grass and handling the treated grass cuttings, or people using the treated grass for recreation and sport. In amenity turf, recreational exposure is higher than in most other uses of pesticides and in this sector it may be more important than occupational exposure of workers.

6.1 Operator exposure

Operator exposure is mainly dependent on the machinery and type of equipment used. It is important that

assessments are made of operator exposure for all uses. In the EC the 'Uniform Principles'⁹ require that operator exposure assessments must be based on data that realistically reflect the actual conditions of use and the working practices involved. These will vary from country to country and may be influenced by the local requirements of training and/or codes of practice.

For vehicle-powered machinery, application to amenity turf may employ similar tractor-powered equipment to that used in some agricultural operations. In such cases, the levels of operator contamination would be expected to be similar. Some machinery used in amenity turf, such as mini-tractors and All-Terrain Vehicles (ATV) are small and often without a cab, so there can be greater operator exposure. A mitigating factor is that, compared to some agricultural uses, the scale of use may be lower. It is also common for knapsack- and pedestrian-controlled sprayers to be used in amenity situations. Knapsack use also results in higher operator exposure compared to tractor use, even after adjusting for the lower work rates. Where a product is approved for knapsack use for agricultural situations, then the use on amenity turf is not likely to raise further concerns. However if agricultural use is confined to conventional tractor-mounted sprayers then the increased exposure from hand-held or other equipment must be addressed.

Models have been developed to examine operator exposure, e.g. the UK Predictive Operator Exposure Model (POEM),^{11,12} the German model¹³ and the North American Pesticide Handlers Exposure Database (PHED).^{14,15} The 'Authorisation Directive'¹³ requires exposure estimates based on suitable calculation models to be submitted and applicants have been guided to the POEM and German models. Work is underway to produce a harmonised European model, EURO-POEM.¹⁶

These models are based on using certain types of machinery and likely scales of use. For use on amenity turf, because of the different machinery described above, and lower scales of use, new exposure data or information on work rates may have to be generated. Where available models are applicable and predicted exposure indicates a concern, then exposure data may have to be provided to refine some of the model assumptions. In some instances producing dermal absorption data may be an alternative course to refining the exposure estimate.

The 'Uniform Principles'⁹ state that approval or authorisation cannot be granted for uses where the likely exposure exceeds the level at which there is a negligible risk of adverse health effects in humans. To reduce exposure to an acceptable level it is possible to introduce exposure reduction requirements, preferably technical controls, as part of the conditions of use. As a lower preference, personal protective equipment for the operator can be specified. However, these must be

readily obtainable and must be practicable under the proposed conditions of use.

6.2 Exposure of public bystanders and other workers

The potential for direct exposure of public bystanders during application is greater than in agricultural situations because of the greater potential access to golf courses, bowling greens and other public areas. Major machinery differences are probably not an important influence; spray characteristics, and hence off-target drift, may be considered to be similar to those in agricultural settings. The EUROPOEM group are currently considering this aspect of exposure assessment; in the meantime applicants could usefully compare the likely level of exposure of unprotected persons from drift based on the various drift data available^{17,18} with the acceptable level of exposure. Where the potential level of direct exposure of bystanders is unacceptable, personal protective equipment is obviously not an option. Exposure has to be avoided by exclusion requirements and separation distances that may be attached to the conditions of use, in addition to those that may be found in any Codes of Practice.

The second potential route of exposure of bystanders occurs on entry to the treated area. The 'Uniform Principles' identifies such re-entry exposure as 'worker exposure'. This is an area of non-dietary exposure assessment which is still developing. The lead has been in the USA with concern of exposure of people harvesting crops to organophosphate and similar residues. Attention has now extended to other activities and situations. Of particular concern is exposure to children as highlighted in the report of the USA National Academy Research Council Committee on Pesticides in the Diets of Infants and Children.¹⁹

Workers re-entering treated amenity turf areas, for example to cut the grass, must also be considered. Their exposure has been shown to be related to the levels of dislodgeable foliar residues (DFR) and the amount of contact with the foliage (which depends on the specific work activity and the nature of the crop). Where such relationships exist it is therefore possible to extrapolate to new scenarios rather than making new measurements of exposure to predict potential exposure from the level of DFR: DFR are easier to collect than performing new exposure studies. There are currently no established protocols for such studies or assessments directly written for turf.

The USA Environmental Protection Agency (EPA) has in the past evaluated exposures to turf pesticides based on procedures for agricultural workers. However it has been concluded that data to better establish exposure to turf pesticides are required to support registration and an industry task force has been established. The task force is currently considering whether the data

base it hopes to establish would be applicable within the EC; these data would of course be subject to proprietary rights. In addition, the EPA are currently in the process of revising the Pesticide Assessment Guideline,²⁰ which deals with post-application exposure monitoring test guidelines.

7 EFFICACY CONSIDERATIONS

Because of the different conditions encountered, a company developing a product for use on amenity turf would normally conduct a full programme of efficacy trials with their product. The first issue is whether the product is effective against the intended target. Weeds of newly sown amenity turf may be similar to those in cereals or short-rotation grassland and trials results would be relevant. Invertebrate pests found in amenity turf are similar to those found in established agricultural grassland and results from trials in the latter area would also support amenity turf use. However, many of the most important diseases and weeds of established amenity turf are different to those found in agriculture, e.g. dollar spot (*Sclerotinia homoeocarpa* F. T. Bennett) and slender speedwell (*Veronica filliformis* Sm.), and specific trials on these would be required. When co-formulants such as surfactants are changed during the creation of a new formulation for use on amenity turf, it may be necessary to check that the new formulation is as effective as that examined in other sectors. In general, two years' testing of efficacy is required in the EC.

Safety to the turf being treated is an important concern in the amenity turf sector. The grass species found in the turf can be more susceptible to damage by pesticide application than those used in agricultural grassland. Of particular concern is the treatment of fine sports turf such as found on golf greens, bowling greens and cricket squares. In most cases no phytotoxicity to the grass can be tolerated. A product intended for fine sports turf use should be screened across a representative range of the species and varieties used in these areas. In the UK, an example of such a screen has been set up at the Sports Turf Research Institute, Bingley, W. Yorks (STRI, pers. comm.). In the amenity turf area, because of the application machinery used, overlapping of spray swaths can occur, so that herbicides must be non-phytotoxic to the turf at double the recommended dose.

Some of the concerns that arise when using a plant growth regulator in amenity turf are different from those occurring in other sectors. Concerns over the interaction with mowing regimes, the wear and tear on the turf from sport and the different grasses constituting the turf mean that specific trials must be carried out. It must be checked that, when used long-term, the growth regulator does not have an adverse effect on the species composition of the turf.

For products that might be used on grass that is then collected for use as a mulch, or for composting, the persistence of the active substance in grass clippings must be considered. Persistence in grass clippings is not related to the persistence of the product in soil. Tests may have to be carried out, placing clippings from treated grass directly around plants, or using them as a growing medium after composting. This aspect is more of a concern for products that might be used by the home gardener.

An increasing problem in controlling 'pests' in all areas of agriculture/horticulture is the development of resistance to pesticides. Resistance has developed in dollar spot in the USA and many active substances are affected.²¹ The EC 'Authorisation Directive'³ takes an active line on pesticide resistance. Laboratory and field data that exist must be submitted and, when necessary, a strategy to manage the resistance must be produced. Although the data may have to be reinterpreted for the amenity turf sector, knowledge of problems of resistance with an existing active substance should be available already from its agricultural/horticultural uses.

Laboratories generating data to answer safety concerns have had to be accredited as performing work to Good Laboratory Practice (GLP) for some time. This has not been a requirement for efficacy testing facilities. As part of the 'Authorisation Directive'³ the EC have made it a requirement that all efficacy testing facilities must be recognised as operating to a required standard. The standards and how Member States must implement them have been laid down.⁵ Some Member States have introduced a system to implement this Directive, in which all trials organisations are registered with the authorities and the facilities are audited to ensure that they comply with the standard required. The UK, Germany and others are still considering the best way forward and discussions are underway with the Commission. Any organisation carrying out efficacy trials on amenity turf will have to ensure that it is 'officially recognised' by the relevant competent authority. If a company employs contractors to carry out the work it should ensure that these contractors have received, or are seeking, 'official recognition'.

8 MUTUAL RECOGNITION OF AUTHORISATIONS ACROSS THE EC

One of the main aims of the 'Authorisation Directive' of the EC was the recognition in one Member State of the authorisations granted in another Member State. This should make the situation easier in the future for a company intending to market an amenity product across the EC. Where an active substance is on Annex I and an authorisation has been granted in one Member State, all other Member States should grant an authorisation for the same product where conditions have been demonstrated to be comparable.

The extent of the data required to demonstrate comparability is currently under discussion. Comparability needs to be demonstrated only for concerns where different environmental conditions could affect the results of trials and the evaluation of the data, i.e. ecotoxicology, environmental fate and behaviour, efficacy and residues. Many agrochemical companies have suggested that they will continue to carry out work in most Member States, but are reducing the extent of testing in each State. This should reduce the cost of data production across Europe.

The UK has allowed the use of efficacy data generated from outside Europe. Some turf diseases, e.g. dollar spot, are more prevalent in North America and work from there has been accepted in support of efficacy submissions made in the UK. The UK believes that as long as studies are relevant and have been carried out to the agreed standard the results should be accepted.

At the moment there is no formal move towards harmonising the issuing of product approvals on a wider basis than within the EC. However, much effort is being made to reach wider agreement, through organisations such as the OECD, on the methods that are employed to generate the data and to evaluate the acceptability of the product.

9 MINIMISATION OF PESTICIDE USE

Throughout the world there is concern over the level of pesticide use and attempts have been made to reduce this level. Examples from within the EC demonstrate the different approaches that may be employed to achieve this. In the Netherlands, Sweden and Denmark there has been a decision that pesticide use must be reduced by stated amounts over a period of time. The UK has not set a target for such a reduction, but has a policy that pesticide use must be the minimum that is effective for the purpose. This relates to all pesticide use, including amenity turf pesticides. The UK government funds research and development into alternatives to pesticides and into ways of achieving better use of pesticides, e.g. forecasting and thresholds. Efforts are being made to ensure users are aware of these techniques and adopt them. The 'Authorisation Directive'³ reinforces the minimisation policy by making it a requirement that only the minimum consistently effective dose should be authorised.

Integrated Pest Management or Crop Management schemes are being introduced in many sectors to lay down methods for reducing pesticide and other inputs. Although not yet fully developed for amenity turf in the UK, the techniques used in such schemes should be considered in the amenity turf area. Using varieties resistant to invertebrate pests and diseases, better

timing and delivery of pesticides and the possibility of introducing biological control agents, can reduce pesticide use.

10 PACKAGING

There are concerns over disposal of waste and measures to encourage the recycling of packaging in many countries. The EC has adopted a Directive (European Parliament and Council Directive 94/62/EC)²² to harmonise these measures within its territory. This aims to recover between 50 and 65% of all packaging waste by the year 2001. In the agricultural sector of the pesticide business in the UK there are already pilot schemes operating. Some schemes are developing reusable packs while in others the packaging material will be collected and utilised as fuel. The problem is that, even after washing, containers that have held pesticides are regarded as hazardous waste and cannot be recycled by being made into new packs. With the lower scale of use in the amenity sector these schemes will be harder to introduce.

The other aspect that affects packaging of pesticides is their labelling as hazardous preparations. There are ongoing discussions on standardising the labelling and classification of all hazardous preparations in the EC. There has been no agreed outcome to these discussions as yet.

11 GENETICALLY MODIFIED ORGANISMS

There are a different set of regulations covering the release of genetically modified organisms (GMO), either for experiments or marketing. Controls have been introduced across the EC with a Directive to cover their deliberate release into the environment (Council Directive 90/220/EC).²³ In the UK, the Advisory Committee on Releases into the Environment decides on the acceptability of the GMO for release, with regard to any possible effects on the environment.

With genes for resistance to herbicides being introduced into many plant species, it is possible that this could happen with amenity grasses. This could extend the range of herbicides that could be applied selectively in amenity turf. The use of pesticides on a GMO is controlled under the same pesticide regulations as described previously. It is also possible that other types of modification, such as drought resistance, might be developed in the future.

It is interesting to note that in the UK the development of a herbicide-resistant amenity grass species, tolerant of amitrole, came from more traditional breeding techniques.

12 CONCLUSION

A company developing a product for use on amenity turf faces large costs at first sight. However, because the active substance is likely to have been, or be in the process of being, developed for several markets, these costs should be shared with other areas of use. When making the application for authorisation in most areas of concern the important task will be to re-interpret available data, rather than carry out new work. Account must be taken particularly of the possibly larger doses applied, differing exposure of operators and bystanders, and of efficacy considerations. As well as considering gaining authorisation for new active substances, a company producing pesticides must continue to update its database to answer any concerns when a review takes place. The company must be aware of legislation on the minimisation of use of pesticides, on packaging and on control of release of GMO, if being developed.

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